# Black Bear Population Analyses
# 2004

By Robert E. Rolley, Amber M. Roth, and Pamela S. Engstrom

## Abstract

Bear visitation rates averaged 58% for 18 bait station surveys conducted in the primary range (Zones A, A1, and B), and 38% for 7 surveys conducted in the peripheral range (Zone C). Adjusted population models produced a statewide estimate of approximately 12,200 bears in Fall, 2004. Bear populations now appear to be near or slightly above goals in all Bear Management Zones except for Zone C where it is approximately 50% higher than the goal. A harvest of 2,500 bears was recommended for the 2004 season.

## Methods

Bear bait station surveys were conducted by wildlife management and research personnel in the 18 counties comprising the primary bear range and 7 counties within the peripheral range in 2004. The surveys were run between 15 June and 15 July, and consisted of 50 bait stations placed at 0.5-mile intervals along driveable roads. A plastic mesh overwrap bag filled with approximately 2 lb. of fresh meat was securely wired to a tree about 7 ft above the ground at each bait station. Bait stations were checked for bear visitations after 7 nights.

A station was considered to have been visited by bears if the bag of meat was gone and the wire securing it had been stretched or broken, or by marks on the trees and/or trails leading to the station. Bait stations were considered inoperable and not included in the calculations if they could not be found or if animals other than bears had taken the bait.

Three-year running average visitation rates ([year x 2 + year$^{+1}$]/3 for first year; [year$^{-1}$ + year x 2]/3 for last year, and [year$^{-1}$ + year + year$^{+1}$]/3 for all other years) were used as an independent index to bear population trends. Combining years reduced annual fluctuations resulting from rather small sample sizes and large annual changes in the abundance of natural foods.

All bears legally harvested were registered at DNR or cooperative stations. A lower first premolar was collected as the bears were registered, and the sex and county of kill were recorded for each bear. Registration personnel were provided instructions and envelopes for storing the teeth. Teeth were sent to the Matson's Lab in Milltown, MT for processing, and ages were assigned by counting annuli in the cementum.

Wisconsin's Bear Population Model was adapted from the one developed and used in Minnesota. That model was updated in 2003 to include the most recent bear harvest, age, and bait station data, and used to estimate bear populations in each Bear Management Zone (Figure 1). Starting population size in the model was adjusted in zones A, B, and C in 2003 to improve the correlation between model simulated population trends and trends in bait-station visitations.

U.S. Department of Agriculture, Animal Plant Health Inspection Service, Wildlife Services (WS) personnel took over Wisconsin's bear damage/nuisance abatement work in 1990 (Engstrom and Kohn 2000). Beginning in 1995, WS personnel chemically immobilized and ear-tagged most bears captured $\geq$30 days prior to the bear hunting season. Bears captured within 30 days of the bear hunting season could not be chemically immobilized due to human health

regulations. Numbers of ear-tagged bears handled each year by WS and numbers of those shot that same year were used to calculate another estimate of the adult bear population using procedures described by Chapman (1951) and Seber (1982). These estimates were compared to those estimated by our population model.

## Results

Bear visitation rates in the 2004 Bear Bait Station Survey averaged 73% in Zone A, 49% in Zone A1, 48% in Zone B, and 58% in the primary bear range (Zones A, A1, and B combined) (Table 1). Bear visitation rates in Zone C (peripheral range) averaged 38%. The visitation rate in Zone C may be inflated slightly because Polk County was not surveyed this year.

The 3-year mean visitation rates in the primary bear range increased rather steadily and significantly from 1985 (32%) to 1996 (55%) and then largely stabilized (1997-2004 average = 54%, Fig. 2). In contrast, the Bear Bait Station Survey suggests a steady increase in the bear population in Zone C during the past 7 years, 3-year average visitation rates increased from 14% to 38% during 1997-2004.

Teeth were collected from 2,414 of the 2,905 bears harvested in 2003 (Table 2). The age structure of bears harvested has been relatively stable since the initiation of the quota system in 1986. Mean ages of bears harvested have ranged from 3.1 - 4.3 years for males and 4.2 - 5.3 years for females.

Adjustments to the starting population size for bear population models in zones A, B, and C improved correlations between simulated population trends and trends in bait-station visitations. Adjusted models produced a statewide population estimate of approximately 12,200 bears in Fall, 2004 (Table 3). This included 4,600 bears in Zone A, 3,350 in Zone A1, 2,450 in Zone B, and 1,800 in Zone C. The 2004 population estimates equate to bear densities of 0.8 bears/$mi^2$ of bear range in Zone A, 0.6 bears/$mi^2$ in Zone A1, 0.5 bears/$mi^2$ in Zone B, and 0.3 bears/$mi^2$ of occupied range in Zone C. Population trends calculated by the models for the primary range generally paralleled those suggested by the Bear Bait Station Surveys (Fig. 2). The adjusted population model for Zone C suggests a steadily increasing population over the past 16 years. Population trends generated by these models and the bait station surveys should be periodically compared as a basis for potential recalibration of the models.

In 2003, WS personnel ear-tagged 68 new bears involved in damage/nuisance complaints and 7 bears ear-tagged in previous years. Of these, 72 were adults available for harvest in Wisconsin during the 2003 Black Bear Season and 16 of them were harvested (Table 4). This produced an estimate of approximately 12,500 adult bears statewide in Fall, 2003 as compared to an estimate of 10,000 adults produced by the population model. In all 8 years the confidence intervals around the mark-recapture estimates included the model estimates of the number of adult bears, and in 6 of the 8 years the mark-recapture estimates were within 20% of the model estimates. When averaged across the 8 years, the mark-recapture estimates were about 10% higher than the model estimates. Mark-recapture estimates were not calculated for 2001 because only 25 bears were ear-tagged that year.

Bear population estimates in Zones A, A1, and B are near or slightly above goals, whereas the bear population estimate in Zone C is approximately 50% above the prescribed goal. The WDNR Bear Advisory Committee recommended a harvest of 2,500 bears for the 2004 season. This included 700 bears in Zone A, 1,000 in Zone A1, 380 in Zone B, and 300 in Zone C.

**Literature Cited**

Chapman, D. G. 1951. Some properties of the hypergeometric distribution with applications to zoological sample census. Univ. Calif. Publ. Stat. 1:131-160.

Engstrom, P. and B. Kohn. 2000. Black bear damage and nuisance complaints, 2000. Wisconsin Wildlife Surveys 11(2):18-20.

Seber, G. A. F. 1982. The estimation of animal abundance and related parameters, 2nd ed. Macmillian Publ. Co., Inc., New York, N.Y. 653pp.

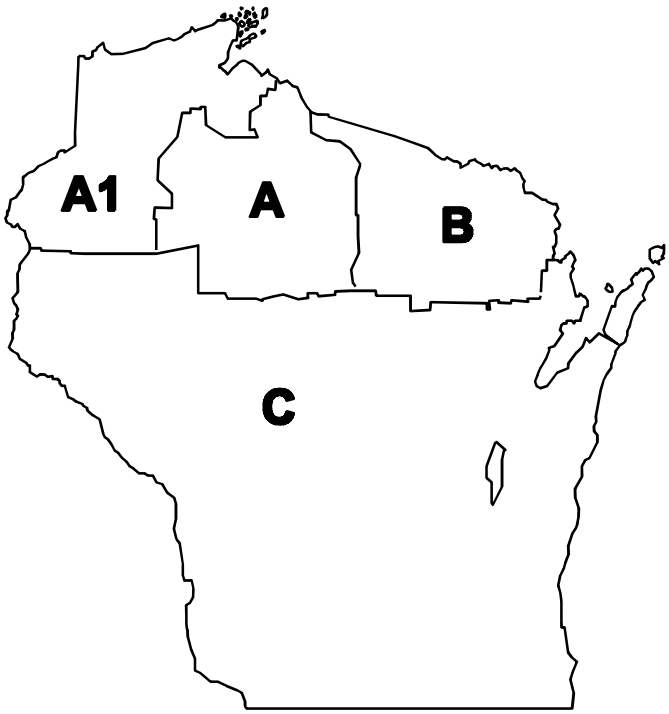


**Figure 1.** *Wisconsin's Black Bear Management Zones, 2004.*

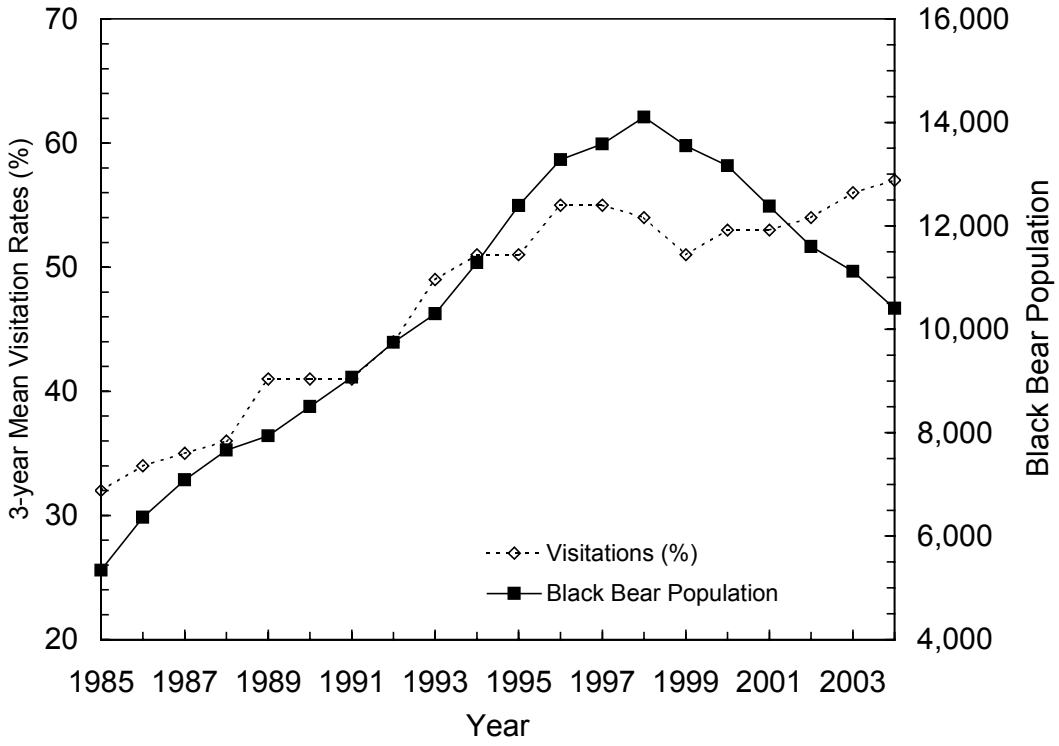


**Figure 2.** *Bear visitation rates on bait station surveys (3-yr running average) and population estimates calculated by the model for the primary range (Zones A, A1, and B), 1985-2004.*

**Table 1.** *Percent of bear bait stations visited by bears, 1993-2004.*

| County | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ashland | 51 | 49 | 68 | 79 | 68 | 48 | 68 | 82 | 63 | 51 | 57 | 86 |
| Bayfield | 65 | 67 | 77 | 67 | 32 | 83 | 83 | 67 | 64 | 79 | 65 | 46 |
| Burnett | 46 | 29 | 23 | 50 | 39 | 63 | 60 | 71 | 84 | 53 | 36 | 32 |
| Douglas | 49 | 33 | 58 | 41 | 43 | 37 | 62 | 61 | 30 | 33 | 33 | 30 |
| Florence | 70 | 56 | 50 | 44 | 38 | 46 | 64 | 54 | ---- | 34 | 53 | 67 |
| Forest | 37 | 74 | 59 | 66 | 88 | 26 | 43 | 61 | 55 | 58 | 60 | 74 |
| Iron | 61 | 58 | 55 | 69 | 86 | 58 | 48 | 41 | 42 | 47 | 55 | 79 |
| Langlade | 35 | 31 | 49 | 45 | 62 | 29 | 30 | 48 | 44 | 56 | 53 | 54 |
| Lincoln | 53 | 59 | 72 | 60 | 76 | 52 | 41 | 55 | 33 | 68 | 44 | 27 |
| Marinette | 42 | 30 | 7 | 26 | 19 | 26 | 44 | 35 | 39 | 65 | 24 | 47 |
| Oconto | -- | 7 | 2 | 12 | 16 | 6 | 18 | 6 | 25 | 47 | 28 | 31 |
| Oneida | 46 | 45 | 12 | 32 | 67 | 23 | 66 | 23 | 36 | 63 | 95 | 70 |
| Price | 74 | 65 | 64 | 66 | 88 | 43 | 31 | 50 | 50 | 42 | 68 | 78 |
| Rusk | 86 | 74 | 64 | 97 | 85 | 71 | 84 | 84 | 91 | 72 | 58 | 80 |
| Sawyer | 56 | 73 | 52 | 87 | 93 | 66 | 76 | 68 | 91 | 91 | 79 | 67 |
| Taylor | 22 | 19 | 18 | 48 | 46 | 62 | 52 | 42 | 36 | 50 | 57 | 58 |
| Vilas | 42 | 57 | 53 | 57 | 57 | 36 | 52 | 31 | 34 | 26 | 47 | 33 |
| Washburn | 93 | 72 | 91 | 85 | 84 | 60 | 90 | 91 | 74 | 88 | 85 | 84 |
| **Primary Range** | **55** | **49** | **48** | **57** | **60** | **47** | **56** | **51** | **52** | **56** | **54** | **58** |
| Barron | | | -- | -- | 16 | 26 | 11 | 30 | 28 | 17 | 11 | 20 |
| Chippewa | | | 30 | 39 | 27 | 15 | 52 | 41 | 20 | 44 | 50 | 42 |
| Clark | | | 19 | 22 | 6 | 12 | 33 | 16 | 39 | 54 | 52 | 64 |
| Jackson | | | 6 | 11 | 13 | 27 | 0 | 28 | 11 | 20 | 15 | 14 |
| Marathon | | | 29 | 20 | 32 | 7 | 8 | 13 | 32 | 66 | 69 | 65 |
| Menominee | | | 19 | 14 | 14 | 8 | 5 | 46 | 6 | 11 | 9 | 35 |
| Polk | | | -- | -- | 2 | 8 | 4 | 9 | 7 | 2 | --- | --- |
| Shawano | | | -- | 0 | 0 | 0 | 0 | 0 | 7 | 0 | --- | 11 |
| **Peripheral Range** | | | **21** | **17** | **13** | **13** | **14** | **23** | **19** | **27** | **37** | **38** |

**Table 2.** *Age classes of bears harvested in Wisconsin, 1986-2003.*

| Year | Sex | Percent in age class | | | No. aged | Mean age |
|---|---|---|---|---|---|---|
| | | 1-2 yr | 3-9 yr | 10+ yr | | |
| 1986 | Male | 59.5 | 37.2 | 3.3 | 210 | 3.6 |
| | Female | 43.8 | 41.3 | 9.9 | 121 | 4.2 |
| 1987 | Male | 52.6 | 43.2 | 4.2 | 401 | 4.1 |
| | Female | 41.5 | 52.0 | 6.5 | 200 | 4.6 |
| 1988 | Male | 60.4 | 35.0 | 4.6 | 439 | 3.7 |
| | Female | 40.9 | 51.9 | 7.2 | 345 | 4.7 |
| 1989 | Male | 53.9 | 39.0 | 7.1 | 397 | 4.2 |
| | Female | 42.5 | 47.9 | 9.6 | 261 | 5.0 |
| 1990 | Male | 67.0 | 30.4 | 2.6 | 454 | 3.4 |
| | Female | 46.8 | 48.1 | 5.1 | 331 | 4.6 |
| 1991 | Male | 56.9 | 37.3 | 5.8 | 448 | 4.0 |
| | Female | 38.9 | 54.9 | 6.2 | 306 | 4.7 |
| 1992 | Male | 63.9 | 32.1 | 4.0 | 474 | 3.5 |
| | Female | 48.4 | 45.0 | 6.6 | 380 | 4.3 |
| 1993 | Male | 50.9 | 41.7 | 7.4 | 405 | 4.3 |
| | Female | 37.8 | 57.3 | 4.9 | 286 | 4.6 |
| 1994 | Male | 62.6 | 31.4 | 6.0 | 441 | 3.9 |
| | Female | 50.9 | 45.0 | 4.1 | 271 | 4.2 |
| 1995 | Male | 55.7 | 41.4 | 2.9 | 600 | 3.6 |
| | Female | 37.7 | 52.0 | 10.5 | 435 | 5.3 |
| 1996 | Male | 60.0 | 37.3 | 2.7 | 771 | 3.6 |
| | Female | 46.8 | 45.6 | 7.6 | 536 | 4.7 |
| 1997 | Male | 65.0 | 32.6 | 2.5 | 765 | 3.5 |
| | Female | 47.9 | 44.2 | 7.9 | 620 | 4.6 |
| 1998 | Male | 65.0 | 33.4 | 1.6 | 1,134 | 3.3 |
| | Female | 49.0 | 44.2 | 6.9 | 904 | 4.5 |
| 1999 | Male | 67.6 | 29.9 | 2.4 | 1,058 | 3.3 |
| | Female | 51.5 | 39.3 | 9.2 | 954 | 4.7 |
| 2000 | Male | 68.1 | 29.0 | 2.9 | 1,227 | 3.3 |
| | Female | 49.8 | 41.5 | 8.7 | 1,046 | 4.7 |
| 2001 | Male | 67.8 | 29.2 | 3.0 | 1,250 | 3.4 |
| | Female | 51.2 | 40.8 | 8.0 | 1,023 | 4.6 |
| 2002 | Male | 59.5 | 34.6 | 5.9 | 1,094 | 3.9 |
| | Female | 44.5 | 43.7 | 11.8 | 946 | 5.2 |
| 2003 | Male | 64.3 | 33.3 | 2.4 | 1,349 | 3.1 |
| | Female | 48.4 | 43.0 | 8.2 | 1,065 | 4.6 |

**Table 3.** *Modeled bear population estimates by Management Zone, 1988-2004*[a]

| Year | Bear Management Zone | | | | State |
|---|---|---|---|---|---|
| | A | A1 | B | C | |
| 1988 | 3,500 | 2,650 | 1,550 | 650 | 8,350 |
| 1989 | 3,500 | 2,800 | 1,650 | 700 | 8,650 |
| 1990 | 3,650 | 3,050 | 1,800 | 850 | 9,350 |
| 1991 | 3,850 | 3,350 | 1,850 | 900 | 9,950 |
| 1992 | 4,050 | 3,700 | 2,000 | 950 | 10,700 |
| 1993 | 4,150 | 4,100 | 2,100 | 1,000 | 11,350 |
| 1994 | 4,450 | 4,650 | 2,200 | 1,050 | 12,350 |
| 1995 | 4,950 | 5,050 | 2,350 | 1,200 | 13,550 |
| 1996 | 5,600 | 5,350 | 2,400 | 1,200 | 14,550 |
| 1997 | 5,800 | 5,400 | 2,400 | 1,250 | 14,850 |
| 1998 | 6,150 | 5,500 | 2,450 | 1,350 | 15,450 |
| 1999 | 5,900 | 5,200 | 2,400 | 1,400 | 14,950 |
| 2000 | 5,700 | 4,950 | 2,500 | 1,500 | 14,650 |
| 2001 | 5,400 | 4,450 | 2,500 | 1,600 | 13,950 |
| 2002 | 4,950 | 4,150 | 2,500 | 1,600 | 13,200 |
| 2003 | 4,800 | 3,800 | 2,500 | 1,800 | 12,900 |
| 2004 | 4,600 | 3,350 | 2,450 | 1,800 | 12,200 |
| Goal | 4,600 | 3,300 | 2,200 | 1,200 | 11,300 |

[a] Population estimates for zones A, B, and C differ from those previously reported due to adjustments to the starting population size in the model.

**Table 4.** *Adult bear population estimates calculated from bears ear-tagged by WS personnel, 1995-2004*

| Year | No. of Tagged Bears | No. of Tagged Bears Shot | Harvest | Adult Population Estimate | ± 95% Conf. Int. | Adult Pop. Estimate from Pop. Model[a] |
|---|---|---|---|---|---|---|
| 1995 | 171 | 28 | 1,737 | 10,300 | 3,300 | 10,500 |
| 1996 | 180 | 35 | 2,325 | 11,700 | 3,300 | 11,200 |
| 1997 | 146 | 31 | 2,178 | 10,000 | 3,000 | 11,500 |
| 1998 | 78 | 13 | 3,184 | 18,000 | 8,200 | 12,000 |
| 1999 | 95 | 19 | 2,881 | 13,800 | 5,200 | 11,500 |
| 2000 | 56 | 15 | 3,075 | 11,000 | 4,400 | 11,300 |
| 2001[b] | 25 | --- | 2,897 | --------- | ------- | --------- |
| 2002 | 84 | 20 | 2,471 | 10,000 | 3,600 | 10,200 |
| 2003 | 72 | 16 | 2,905 | 12,500 | 5,000 | 10,000 |

[a] Adult population estimates from models differ from those previously reported due to adjustments to the starting population size in the models.

[b] Population estimate not calculated from ear-tagged bears in 2001 due to small sample size.